Transportation Safety Board of Canada

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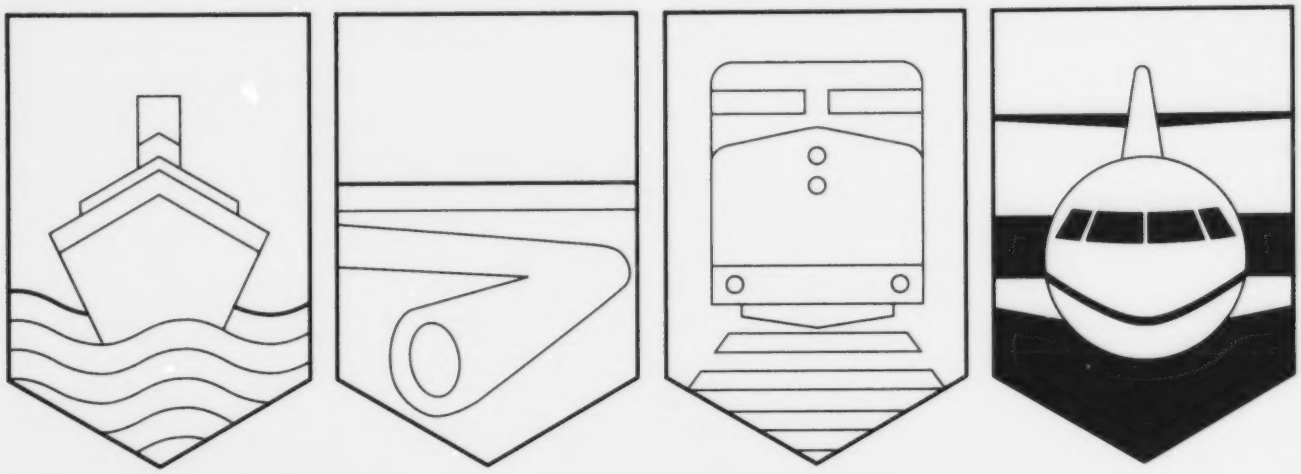

REPORT OF A SAFETY STUDY ON VFR FLIGHT INTO ADVERSE WEATHER

REPORT NO. 90-SP002

Canada

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1.0 INTRODUCTION

1.1 Background

Accidents in which the aircraft was operated under Visual Flight Rules (VFR) into adverse weather conditions occur regularly, claiming a disproportionately high number of fatalities each year. They involve professional pilots, private pilots and business pilots who fly general aviation aircraft and chartered commercial aircraft, including fixed-wing aircraft and helicopters.

The regularity with which these accidents have occurred, and the seriousness of the continuing loss of life, prompted the Canadian Aviation Safety Board (CASB) to initiate a comprehensive and systematic examination of the issue. In March 1990, when this report was nearing completion, the CASB was replaced by the Transportation Safety Board of Canada (TSB), under whose auspices this report is now published.

During the last two decades, a number of foreign government agencies have undertaken measures to more fully understand these types of accidents. Recent studies emphasize both the complex decisional nature of continued VFR flight into adverse-weather and the often fatal consequences. This Safety Study is the first comprehensive review of the topic in Canada in recent years, and builds upon these earlier works.

1.2 Aim

The objective of this study is to examine the contributing factors to accidents which involved the initiation or continuation of flight under VFR despite adverse weather conditions.

Particular attention is made to:

— the requirements for obtaining and retaining an Instrument Flight Rules (IFR) rating; and

— the capability of and the requirement for Air Traffic Services (ATS) to assist VFR pilots in distress due to deteriorating weather.

1.3 The Conduct of The Safety Study

The scope of the safety study was confined to accidents which involved Canadian-registered aircraft in Canadian territory, over the ten year period between 1976 and 1985. There were 352 weather-related accidents occurring to Canadian registered aircraft; of these, nineteen occurred outside of the country and were excluded. Information from the remaining 333 accident investigations was extracted from the CASB data base and analyzed in relation to all Canadian occurrences during this period. Consequently, the seriousness of the issue was assessed, and the trends specific to the accidents in the study population were identified and examined.

The accident data were analyzed in two ways. First, accidents were clustered to simplify the identification of patterns. Accidents with similar characteristics were assigned to the same

cluster. Clusters were examined individually and comparatively to identify distinct trends. Second, the accidents were examined in the context of particular safety issues identified in the findings of individual investigations, other safety studies, and secondary source material. The accident experience was examined in the context of the classic "man/machine/environment" model of safety analysis.

By this process, the trends identified by numerical tabulation were examined in the light of any apparent deficiencies which existed in the regulations, the industry practices, and/or the general operating practices in the aviation environment. The analysis accounted for revisions to the regulations which have occurred during the years 1986 to 1990.

The detailed staff report of the safety study on which this final TSB report is based is available under separate cover.

1.4 Report Format

The material from the staff report has been organized in this TSB final report into seven sections to facilitate analysis. Section 2 pertains to the regulations which generally govern VFR flight. Section 3 addresses safety deficiencies particular to VFR flight at night, while Section 4 focuses on issues pertaining to pilot licences and licence endorsements. Section 5 deals with the commercial operating environment in Canada, Section 6 with aircraft equipment, and Section 7 with such Transport Canada (TC) responsibilities as safety promotion and the dissemination of aeronautical weather information. The report contains recommendations which pertain to the operation of all VFR flights in Canada, some which relate to only commercial operations, and some which are specific to only fixed-wing or helicopter operations. To assist in locating recommendations which pertain to specific aircraft categories or types of operations, the reader is directed to Appendix B of this report, where a cross-reference is located.

1.5 General Observations

A comparison of this category of accident to all other accidents to Canadian-registered aircraft verified the need to more fully examine accidents occurring to VFR flights in adverse weather conditions. Although they involved only 352 of the 5,994 accidents recorded between 1976 and 1985 (6% of the total), they accounted for 23% of all fatal accidents and took the lives of 418 persons, or 26% of all fatalities during the ten year period. Even though the annual number of accidents involving aircraft governed by VFR which initiated or continued flight into instrument meterological conditions (referred in this report as "VFR-into-IMC" accidents) has declined over the period (as have all aviation accidents), the annual number of fatalities in VFR-into-IMC accidents has remained generally constant. In other words, VFR-into-IMC accidents have claimed an annual proportion of aviation fatalities that has increased with time.*

* Although not all of the investigations for the period 1985-1988 have been finalized and the cause factors assigned, the data which is available suggests that the seriousness of VFR-into-IMC accidents continues. During the years 1985 to 1988, VFR-into-IMC involved 23% of the fatal accidents occurring to Canadian-registered aircraft, and accounted for 22% of the fatalities.

Canadian Registered Aircraft Accidents 1976 – 1985

	Number of Accidents	Number of Fatal Accidents	Number of Fatalities	Number of Serious Injuries
Continued VFR Flight into Adverse Weather	352	177	418	105
All Accidents	5,994	761	1,618	1,031

The Canadian accident experience exhibits similarities to the accident record of other nations. Approximately 12.7% of all the Canadian accidents during this period involved fatalities, but fully 50.2% of Canadian VFR-into-IMC accidents resulted in fatalities. A recently-released National Transportation Safety Board (NTSB) study came to similar conclusions regarding the American accident record: 17.3% of U.S. General Aviation accidents between 1975 and 1986 resulted in fatalities, but 72.2% of VFR-into-IMC accidents were fatal.* Clearly, accidents that result from pilots initiating or continuing VFR flight into adverse weather constitute a significant portion of the annual aviation fatalities in North America.

A comparison between Canadian pilots involved in VFR-into-IMC accidents and all other Canadian accident pilots yielded few differences; indeed, the pilot age, experience, and licence-type were generally similar. Although VFR-into-IMC accident pilots were slightly younger and had flown fewer hours, almost one fifth of the VFR-into-IMC accidents involved pilots with more than 3000 hours total flying time.

The most common types of operations involved in VFR-into-IMC accidents were recreational flying, charter operations, business flying and specialty operations (primarily flying training). In comparison with the averages for all accidents, the most notable feature was the higher incidence of accidents involving charter operations in VFR flight into IMC. Whereas charter operations account for less than 19% of all accidents, they comprised almost 27% of the VFR-into-IMC accidents.

This is cause for concern: charter aircraft, most of which regularly carry fare-paying passengers, are subject to stringent regulatory controls, and are piloted by experienced pilots. Consequently, the analysis of these accidents focused on the underlying causes which could be identified in the circumstances surrounding the accident flights.

VFR-into-IMC accidents tended to occur in the more remote areas of Canada. Four out of ten took place in the "sparsely settled region" as defined in the Air Navigation Orders (ANOs). Lacking the facilities to operate conventionally-configured aircraft in these areas, over one quarter of the aircraft were float- or ski-equipped. Half of the VFR-into-IMC

* U.S., National Transportation Safety Board, *General Aviation Accidents Involving Visual Flight Rules Into Instrument Meteorological Conditions*, Report No. NTSB SR-89/01, February, 1989, pages 3-4.

accidents took place where the terrain was mountainous or hilly.* Typically, accidents involving general aviation aircraft occur over flat areas (i.e. 22% occur in mountainous/hilly terrain).

Specific conclusions derived from the safety study along with appropriate recommendations are categorized and discussed in the following sections: VFR flight; night VFR flight; pilot licensing; industry practices; aircraft equipment; and the role of the TC safety infrastructure.

* A further 13% occurred over rolling terrain.

2.0 VFR FLIGHT

Reduced to its most simple terms, this study examines the ramifications of Air Regulation 542 which states:

> "When operating in accordance with VFR, aircraft shall be flown with visual reference to the ground or water unless otherwise authorized by the appropriate air traffic control unit...."

This regulation is intended to permit safe flight by pilots who possess the most basic skills of navigation and piloting. The section which follows summarizes observations regarding VFR weather minima, Special Visual Flight Rules (SVFR), VFR flight in mountainous terrain, and the practice of 'scud-running'.

2.1 VFR Weather Minima

VFR visibility minima of three miles and one mile have been prescribed for flight by fixed-wing aircraft within controlled and uncontrolled airspace, respectively; i.e. these VFR weather minima, particularly in uncontrolled airspace, permit pilots to fly in conditions whereby visual reference to the earth's surface is limited. Consequently, these regulations implicitly assume that orientation by other than reference to a natural horizon may be required to maintain control during VFR flight.

Seventy-four accidents occurred to pilots who lost control of the aircraft in reduced forward visibility; 80% of these (59) occurred in uncontrolled airspace, where the visibility minimum is one mile. It is extremely difficult to judge one mile forward visibility from a moving aircraft. In some cases, the accidents occurred in weather conditions which met or exceeded the legal minima. In other cases, it is likely that the pilots had difficulty in accurately determining one mile flight visibility from the moving aircraft, and flew into conditions less than those prescribed by regulation. A visibility of one mile leaves no margin for error, and permits pilots to fly in weather conditions in which there is inadequate outside reference to ensure consistent aircraft control. Therefore, the Board recommends that:

> The Department of Transport establish VFR visibility minima which will permit pilots to retain control of their aircraft by outside reference.
>
> TSB-A90-65

Canadian regulations are, in many ways, more stringent for commercial operations than for private operations. However, the criteria for weather minima during day VFR operations for commercially-operated aircraft are the same as those governing any other VFR flight, placing a large number of fare-paying passengers at risk. American weather minima reduce this risk by being more restrictive for commercial VFR operations; Part 135 operators in the U.S. may not conduct flight under VFR in uncontrolled airspace when the ceiling is less than 1000 feet unless the flight visibility is at least 2 miles.

Although these limitations exceed the Canadian provisions, the NTSB in the United States has recently proposed even higher visibility limitations for commercial operations. NTSB recommendation A-89-91 proposes that the Federal Aviation Administration (FAA):

"Restrict 14 CFR Part 135 air carrier (fixed-wing) passenger flights from operating in uncontrolled airspace under visual flight rules (VFR) in less than the basic VFR weather minimums of a 1000-foot ceiling and 3 miles flight visibility".

The NTSB supported this recommendation by information from three accidents in which 14 persons had died. The TSB believes that the circumstances of the 111 accidents between 1976 and 1985 which occurred to Canadian operators warrants similar regulatory revisions. The Board believes that commercial passenger-carrying operations conducted in Canadian uncontrolled airspace in flight visibilities of one mile will continue to experience a high accident and fatality rate. Accordingly, the Board recommends that:

The Department of Transport increase the VFR weather minima for fixed-wing commercial operations in uncontrolled airspace.

TSB-A90-66

2.2 VFR Minima – Mountainous Terrain

The accident data, both in Canada and in the United States, clearly indicate that mountainous terrain is most unforgiving to VFR pilots when weather conditions are poor: 51% of the Canadian VFR-into-IMC accidents occurred in mountainous or hilly terrain. VFR aircraft often transit the mountains through narrow valleys, where they may be subjected to strong winds and severe turbulence. Weather conditions which are highly changeable due to local effects, and variations in topography combine to create areas where VFR flights operate at high risk. Furthermore, the turning radius of many aircraft is increased at the higher altitudes at which they often operate through mountainous terrain.

Transport Canada has designated certain areas of Canada as "Mountainous Regions", and introduced more stringent rules to safeguard IFR flight in mountainous terrain. The need for higher VFR weather criteria has also been recognized, but only for the coastal regions of British Columbia; there, the minimum flight visibility for VFR flight in uncontrolled airspace is two miles. In most of the Designated Mountainous Regions of Canada, the one mile VFR flight visibility minimum is applicable. The Board believes that this minimum is inadequate. Accordingly, the Board recommends that:

The Department of Transport increase the minimum flight visibility for VFR flight in all designated Mountainous Regions to two miles.

TSB-A90-67

2.3 Special VFR (SVFR)

Canadian regulations can permit VFR flight in controlled airspace in weather conditions below the VFR weather minima. SVFR can be authorized during the day or night. During the years 1976 to 1985 in which the studied accidents occurred, SVFR could be authorized in weather conditions ranging from ceilings of 500 feet and three miles visibility, to ceilings of 700 feet and one mile visibility. ANO Series V, No. 1 was amended in June 1990, and now SVFR is permitted when the visibility is one mile, making the Canadian criteria similar to those of the U.S. and the U.K. However, SVFR flight at night, when inclement weather can not be readily discerned prior to entry, is restricted in the U.S. and the U.K. to pilots and

aircraft certified for IFR flight. Such additional restrictions to night SVFR flight have not been included in the amendment to the Canadian regulations.

This study found only six accidents involving SVFR operations. Four of the six occurred during daylight, four occurred when forward flight visibilities were reduced (as opposed to two in which the pilots flew into cloud) and four of them occurred after the pilots lost control of the aircraft. While acknowledging that the accident data are scarce in this regard, the Board believes that in view of Canada's topography, low population density (which affects ground lighting and other visual references), and variable weather, the recent reduction in SVFR weather minima could increase the incidence of VFR-into-IMC accidents in Canada. The new weather minima for SVFR flight will permit greater use of SVFR in weather conditions worse than those which permitted the studied accident flights to occur. Accordingly, the Board recommends that:

> The Department of Transport reconsider the decision to reduce SVFR weather minima to visibilities of one mile.
>
> TSB-A90-68

Canadian regulations make no distinction between day and night SVFR. The American and British regulations, restricting night SVFR to specially qualified pilots flying aircraft equipped for IFR flight, take account of the additional risk of operating in poor weather in low-light or no-light conditions. To obviate conditions in which non-qualified pilots are at risk of encountering adverse weather conditions which require instrument flying skills, the Board recommends that:

> The Department of Transport restrict the authorization of night SVFR to pilots who are instrument-endorsed and who operate aircraft certified for instrument flight.
>
> TSB-A90-69

2.4 VFR-Over-The-Top

Two hundred sixty-six of the accidents (80%) occurred in the enroute phase of flight. The options available to the pilots who encountered the first indications of impending inclement weather included: continuing flight in the adverse conditions in the belief that conditions would improve; conducting a 180 degree turn; or "ducking under" and proceeding around obstacles and inclement weather with the intention of reversing course if conditions deteriorated further. The latter practice, commonly termed 'scud-running', has resulted in pilots regularly operating in weather conditions which jeopardize safe flight.

Regulations in the United States provide American pilots with the options of flying 'VFR-On-Top' and 'VFR-Over-The-Top' (eg: remaining above and clear of cloud). By flying 'VFR-On-Top', U.S. pilots on an IFR flight plan may fly above a cloud deck and in Visual Meterological Conditions (VMC), navigating their IFR-equipped aircraft by means of navigation aids. VFR-Over-The-Top permits the VMC operation of a VFR-equipped aircraft above a cloud deck when it is not being operated on an IFR flight plan. It is not clear to what extent 'VFR-On-Top' or 'VFR-Over-The-Top' provisions have prevented certain types of VFR-into-IMC accidents in the U.S. However, the Canadian operating conditions and the Canadian accident data suggest that Canadian VFR pilots need additional options with which to make decisions when encountering adverse weather enroute.

One such option would be a form of 'VFR-Over-The-Top' which has been adapted from the American practice and which has received the support of members of the Canadian aviation community for some time. VFR-Over-The-Top would permit pilots to climb in visual meterological conditions (VMC), proceed enroute above inclement weather, and descend in VMC at a destination which had been forecast for conditions surpassing VMC for a period extending before and after the intended time of arrival. VFR-Over-The-Top (in other than high density areas) could provide a safe alternative to 'scud-running' and permit pilots to operate in weather conditions for which they are presently trained. To reduce the number of Canadian accidents occurring enroute, the Board recommends that:

> The Department of Transport prescribe conditions and procedures for the conduct of VFR-Over-The-Top in Canada.
>
> TSB-A90-70

3.0 NIGHT VISUAL FLIGHT

Accidents occurring in other than daylight conditions comprised a disproportionately large number of VFR-into-IMC accidents. Approximately 10% of all Canadian accidents occur during the hours of darkness, which parallels estimates of the general level of night flying activity (also 10%). However, VFR-into-IMC accidents occurring during the hours of darkness accounted for almost 30% of the total study accidents. Analysis pointed to three issues: night VFR weather minima; the conditions for obtaining and maintaining a night endorsement; and weather briefings.

3.1 VFR Weather Minima

The consequences of flying in reduced visibilities are exacerbated when operating at night, in light conditions which do not permit sufficient warning for the pilot to see and avoid worsening weather conditions. Inadvertent entry into IMC when the actual conditions can not be seen can be minimized by reducing the possibility of occurrence.

Other countries employ weather minima to reduce the probability of aircraft encountering adverse weather, even during daylight conditions. For instance, in the United States VFR weather minima were recently introduced which prohibit daytime recreational pilots from flight in visibility of less than three statute miles. This measure reduces the risk of bad-weather encounters, and is even more effective for flights at night when bad weather is not so easily detected.

The high proportion of fatal night accidents attributable to adverse weather is in part the consequence of pilots initiating flight in weather conditions which are legally acceptable, but which deteriorate. The first indication to the night-flying pilot can be the inadvertent entry into IMC. The Board believes that, to reduce this risk, VFR flight at night should be restricted to more favourable weather conditions. Accordingly, the Board recommends that:

> The Department of Transport increase VFR weather minima for night flight so as to reduce the risk of inadvertent flight into poor enroute weather conditions.
>
> TSB-A90-71

3.2 Night Endorsement

The night endorsement qualifies the private pilot to fly during the hours of official darkness. To obtain this endorsement, the pilot undergoes a minimum of ten hours training in basic instrument flight manoeuvres. The intent is to prepare the pilot for inadvertent entry into IMC and to familiarize the pilot with aircraft control in conditions in which there is no apparent horizon. Five of the instrument training hours can be acquired in a simulator. No evaluation of competency is required prior to endorsement, nor are there re-certification requirements for the continued exercise of privileges of the endorsement.

Twenty-four studied accidents which occurred at night resulted from a loss of aircraft control, often after the apparent onset of vertigo. To understand the circumstances of such occurrences, the training, experience and skills of the accident pilots were examined. The accident pilots had seldom obtained additional instrument training after acquiring the minimum

experience for night endorsement. Since instrument flying skills are perishable and require regular practice to maintain even a modicum of proficiency, the criteria for obtaining and maintaining a night endorsement apparently do not adequately reflect the skills required to cope with inadvertent entry into adverse weather. There is a higher probability of these circumstances occurring at night.

At present there is no method of ensuring that a minimum level of skill in flying on instruments has been achieved prior to receiving a night endorsement; an evaluation of a pilot's skills under the type of vertigo-inducing conditions encountered in adverse weather at night appears to be warranted. Furthermore, at present there is no method of ensuring that a minimum level of proficiency has been retained after the issue of a night endorsement; therefore, some form of recurrency training and/or testing also appears to be warranted. Such training and testing should focus on the instrument flying skills required for the safe conduct of night visual flight, skills which are considerably less complex than those required, for instance, to conduct a complete instrument approach.

In view of the disproportionate frequency of VFR-into-IMC accidents which occurred at night, the Board recommends that:

> The Department of Transport revise conditions for the issue and maintenance of a night endorsement by:
>
> a) including a practical evaluation of the pilot's skill prior to issue of the endorsement; and
>
> b) verifying continued proficiency on a recurrent basis.

TSB-A90-72

3.3 Night Weather Briefing

In light conditions in which hazardous weather conditions can not be detected until they have been encountered, it is essential that pilots have appropriate information before initiating flight. Seventeen accidents that occurred in other-than-daylight conditions involved pilots who did not use available weather briefing facilities.

Weather information can be obtained by phone, by remotely-located computer terminals, or in-person at a weather office. There are no regulations specifically requiring a weather briefing before VFR flight; yet the probability of inadvertent entry into IMC at night could be reduced if pilots had appropriate information upon which to base their decision to initiate or defer a flight. This applies to all night flights, both private and commercial, but the Board is particularly concerned about the safety of the air transportation system used by fare-paying travellers. The Board believes that the Department of Transport should encourage private pilots to obtain a weather briefing prior to conducting a flight at night, but that the requirement for operations conducted by commercial pilots should be more stringent. Therefore, the Board recommends that:

The Department of Transport require that, prior to initiating night flight under VFR from locations for which weather briefing facilities exist, pilots engaged in commercial passenger-carrying operations obtain a weather briefing.

TSB-A90-73

4.0 PILOT LICENSING

4.1 Private Pilot Licence

Examination of the VFR-into-IMC accident data identified a number of deficiencies in the criteria for acquisition of a Private Pilot Licence. However, a number of initiatives presently underway in TC are likely to redress many of these deficiencies. Specifically, the introduction of five hours instruction in basic instrument flying skills and the addition of pilot decision-making training to the syllabus for the Private Pilot Licence will supplement the knowledge and skills required for flying under VFR in Canada. Aviation physiology will also be introduced to the curriculum for the Private Pilot Licence. Furthermore, plans by Transport Canada to divide the written examinations for the Private and Commercial Pilot Licence into components, each of which shall require a passing grade, should ensure that every pilot has obtained a minimum level of meteorological knowledge at the time of licence issue.

TC has introduced these modifications in response to licensing discrepancies identified by Justice Dubin,* industry representatives, TC's own officials, and CASB investigations. The Board is encouraged by this progress, and finds no reason to make further recommendations at this time.

Examination of the accident data identified a large number which occurred enroute to relatively inexperienced pilots, and a disproportionately high number which occurred to flying/school aircraft in B.C. The minimum experience of 45 flight hours required for a Canadian Private Pilot Licence includes eight hours of cross-country flight, during which the candidate must have completed at least one solo cross-country flight. This is considerably less experience than that required for the U.S. private pilot licence, in which 13 hours of the total 40 hours must be amassed in cross-country flight.**

The large number of weather-related accidents in the enroute phase suggests that a re-examination of this licence requirement is warranted. However, the simple introduction of additional cross-country flying hours would not necessarily provide a solution, as total flying hours could be accumulated several years prior to licence issue. Furthermore, pilots seldom acquire substantially more than 8 hours cross-country flying hours, even when significantly more than the 45 hour minimum total has been amassed. Accordingly, to improve cross-country piloting skills, the training curriculum, flight training practices, and standards of evaluation require examination.

In light of the large number of enroute accidents occurring to inexperienced private-licensed pilots, and particularly in consideration of the high proportion of VFR-into-IMC accidents occurring to flying club/school aircraft in B.C., the Board recommends that:

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* *Inquiry Into Aviation Safety in Canada* (1981-1982) 3 volumes.

** U.S. requirements include a minimum of three hours dual and 10 hours solo (FAR 61.109); Canadian requirements include two hours dual and three hours solo. Personnel Licensing Handbook, Volume 1, Chapter 4, 1-28

The Department of Transport modify the training curriculum, flight training practices and standards of evaluation for cross-country flight training for the Private Pilot Licence.

TSB-A90-74

4.2 Licence Validity

Pilots who had acquired less than 1000 hours total flying time accounted for 56% of the accidents studied. Many of these pilots had acquired very low annual accumulations of flying time over an extended period. Presently, private pilots in Canada are required to satisfactorily complete a written examination only once, prior to licence issue. Without a means of regularly verifying pilots' comprehension of meterological phenomena, their knowledge may diminish to the extent that they can no longer reasonably assess the forecast conditions or the actual weather encountered enroute. Such pilots would undoubtedly have difficulty in making appropriate decisions when they are about to encounter IMC conditions. While this is particularly true of pilots who fly infrequently, a general erosion of the practical aspects of meteorology can be expected amongst most recreational pilots. Accordingly, the Board recommends that:

The Department of Transport periodically verify minimum levels of knowledge in meteorology as a requirement for the continuing validity of the Private Pilot Licence.

TSB-A90-75

Many accident pilots, particularly private pilots, had flown little in the period leading up to the accident. Thirty-nine percent of the private-licensed pilots had flown 20 or less hours in the previous 90 days.

Accident pilots characteristically encountered conditions which required appropriate and timely decisions while they operated their aircraft in deteriorating visibilities through hazardous terrain. Effective decision-making can be impaired if pilots lack confidence in their skills. Furthermore, a disproportionate amount of time and effort may be spent by non-current pilots in the operation of the aircraft, detracting from their assimilation of important cues which would aid in a timely decision. It is impossible to measure the degree to which currency might have influenced the circumstances underlying many of these accidents; nonetheless, the circumstances surrounding many of the accidents examined in this study, in conjunction with the findings of independent studies on factors which induce stress in the aviation environment,* strongly suggest that a lack of currency and/or proficiency consistently jeopardizes rational decision-making.

In the U.S., after the introduction of a mandatory biennial review of proficiency in November 1974, there was a "one-time 10 percent decrease in fatal accident rates beyond the existing long-term declining trend in accident rates".** U.S. authorities have been sufficiently

* See for instance: Dr. Michael Thomas *Managing Pilot Stress* (New York: Macmillan Publishing Company, 1989).

** The United States Government *Federal Register*, volume 54, number 59, Wednesday March 29, 1989, p. 13035

satisfied with the safety dividends accrued by such regulatory requirements that they recently have broadened the provisions to make them more comprehensive.

The Inquiry into Aviation Safety in Canada, conducted by Justice Dubin, recommended similar regulations for Canada. Officials from Transport Canada have spent considerable time examining this issue, and plan to introduce measures shortly that will require proof of currency for the full exercise of licence privileges. Essentially, all pilots wishing to carry passengers will be required to conduct five take-offs and landings in the previous six months, and pilots who have not operated an aircraft in five years will be required to successfully complete a written examination to revalidate their licence. These measures are a step in the right direction. However, they will not fully meet the intent of Justice Dubin's recommendation. Furthermore, they are unlikely to reap the benefits to safety that the American provisions have achieved, nor to significantly influence the circumstances surrounding accidents such as these examined in the study, particularly those which occurred during cross-country or night flight. Consequently, to enhance proficiency through the regular practice of flying and navigational skills, thereby reducing the recurrence of weather-related accidents to pilots with minimal recent experience, the Board recommends that:

> The Department of Transport introduce more stringent requirements for currency of all Canadian licensed pilots which will enhance proficiency in flying and decision-making skills.
>
> TSB-A90-76

In summary, analysis of the accident data concluded that the proficiency of private pilots would be enhanced by regular attendance (perhaps every five years) at a refresher ground school for a comprehensive review of such important topics as pilot decision-making, navigation and meteorology.

4.3 Licence Privileges

As noted earlier in this report, eighty percent of the VFR-into-IMC accidents (and 89% of the fatalities) occurred during the enroute phase of flight. Consequently, the study considered the training and skills in cross-country flying required for licence acquisition, the privileges extended to the licence holder, and the conditions encountered while exercising the privileges of the licence.

Much of the flying training for the Private Pilot Licence focuses on aircraft handling, with relatively few hours dedicated to cross-country flying skills. However, the privileges attached to a licence permit a person, immediately upon licence issue, to fly in conditions which can surpass the knowledge and skill in cross-country flying achieved in initial training. Although inexperienced pilots account for the majority of all accidents in all phases of flight, the adverse-weather-related cross-country accidents are of particular concern because they claim so many fatalities. The accident record indicates a discrepancy between the training requirements and the experience necessary to conduct cross-country flights. In addition to supplementing knowledge and skill during initial licence training, as proposed earlier, further measures are considered necessary to reduce the frequency of accidents during cross-country flights.

The concept of a restricted-privilege Private Pilot Licence is being explored in the United States, where a pilot with a 'recreational' licence with reduced privileges is permitted to fly in restricted locations in more conservative weather minima. To reduce the number of fatalities involving inexperienced pilots engaged in cross-country flying, the Board recommends that:

> The Department of Transport assess the feasibility of amending the privileges of the Private Pilot Licence to require additional licence endorsements for the conduct of cross-country flights with passengers.
>
> TSB-A90-77

The night endorsement to the Canadian Private Pilot Licence permits unrestricted VFR night flight. British regulations are not so permissive: night-endorsed pilots there are not permitted to conduct cross-country night flight unless they also are instrument-rated and are operating an IFR-certified aircraft. This restriction ensures that pilots operating under VFR at night (who have a greater likelihood of unexpectedly encountering IMC) are capable of maintaining controlled flight by sole reference to flight instruments.

Nearly a quarter of the other-than-daylight accidents occurred after the pilots lost control of the aircraft. In consideration of the high proportion of night VFR-into-IMC accidents (see Section 3), most of which occur enroute and many of which result from the pilot having inadvertently encountered IMC, only suitably qualified pilots, flying aircraft certified for IFR flight, should be permitted to conduct cross-country flights at night under VFR. Therefore, the Board recommends that:

> The Department of Transport develop a licence endorsement which permits VFR cross-country flight at night only in aircraft equipped to maintain control of the aircraft by reference to flight instruments.
>
> TSB-A90-78

4.4 Instrument Endorsements

In undertaking this study, there was concern about the role which possession of an instrument rating might play in reducing the number of adverse-weather-related VFR accidents. It had been suggested that American provisions are more amenable to obtaining and maintaining an instrument rating than Canadian provisions. It was hypothesized that if a pilot could obtain an instrument rating more easily, and if it could be renewed with minimal inconvenience, more pilots might file IFR flight plans when confronted with poor weather.

Many difficulties were encountered in examining this issue. Meaningful comparisons of each nation's accident experience are hampered by the inability to measure the impact of differences in regulations, the operating environment, the aviation infrastructure, weather conditions, etc. Furthermore, there was insufficient data from Canada and the United States to compare the rates of accidents amongst instrument-rated and non-instrument-rated accident pilots; this rendered much of the discussion hypothetical. Nonetheless, the analysis which was possible proved instructive.

In Canada in 1985, 1.2% and 15.5% of the Private and Commercial Pilot Licence holders, respectively, possessed instrument ratings; whereas 14.1% and 83.3% of Private and

Commercial Licence holders in the U.S. were instrument-endorsed. Comparison with the findings of the study conducted by the NTSB indicated that American commercially-employed pilots were proportionately less involved in VFR-into-IMC accidents than Canadian commercial pilots. Consequently, there was at least a general indication that instrument ratings had played some role in reducing American adverse-weather-related accidents in VFR operations. However, it was not possible to determine the degree to which the lesser incidence for commercial-licensed pilots in the American data was associated with differences in the operating environments of the two nations, as compared with the knowledge and flying skills associated with the training and experience of an instrument-rated pilot.

Both Canadian and American pilots with instrument flying experience were less likely to be involved in VFR-into-IMC accidents; and U.S. commercially-licensed pilots (who generally possessed instrument ratings) were less apt to be involved in VFR-in-IMC accidents compared to their Canadian counterparts (who generally did not possess an instrument rating). The Board does not wish to degrade the traditionally high safety standards for IFR-endorsed pilots flying IFR; however, any procedures which facilitate obtaining and maintaining instrument flying skills and which could lead to a reduction of VFR-into-IMC accidents should be explored. In light of the high involvement of non-instrument qualified pilots in VFR-into-IMC accidents, the Board recommends that:

> The Department of Transport develop means by which instrument endorsements could be more readily obtained and maintained by Canadian-licensed pilots.
>
> TSB-A90-79

Approximately half of the VFR-into-IMC accidents in Canada occurred to aircraft being operated for private-recreational purposes; the remaining half occurred to aircraft being operated for commercial or private-business purposes.* The aviation and insurance industries generally use flying experience (often measured by total flying hours or experience acquired on aircraft types) to assess risk in the hiring or insuring of pilots. Generally, possession of an instrument rating is only considered when IFR flying will be required. Yet, the limited involvement of instrument-qualified pilots in VFR-into-IMC accidents suggests that an important indication of a low-risk pilot is being overlooked. A pilot with superior qualifications can be expected to be less at risk at incurring the financial and property loss associated with an accident. Acknowledging the reduced risk, incentives such as a reduction in insurance premiums for companies and the introduction of salary bonuses for VFR pilots with instrument endorsements could be expected to positively influence the safety of many types of commercial VFR operations. Therefore, as a means of increasing the competence of commercial pilots employed in such VFR operations, the Board recommends that:

> The Department of Transport promote the adoption of incentive programs in the aviation and insurance industries to encourage increased use of IFR-qualified pilots in VFR commercial operations.
>
> TSB-A90-80

* Approximately 35% were engaged in commercial operations, and 15% were private-business aircraft.

4.5 Helicopter Commercial Pilot Licence

Of the 33 helicopter accidents in the study, 27 occurred when pilots encountered whiteout conditions in which they were not able to visually maintain adequate reference to the ground to avert the accident. When pilots encounter whiteout, they must transition from visual flight and fly away from the hazard by sole reference to the aircrafts' instruments. Only one of the helicopter pilots had an instrument rating. Of the remainder, two had acquired some actual instrument flying time, but neither of these pilots had accumulated more than 20 instrument hours.

Since July 1987, a candidate for a Commercial Pilot Licence for helicopters has had to obtain 20 hours of instrument flight time (combined actual and simulated). Before this, no instrument training was required. Therefore, all the accidents studied involved pilots who had not been required to have instrument training to obtain a licence. Their lack of instrument flying experience is believed to be representative of the experience of most helicopter pilots presently employed in commercial operations. These experienced pilots fly in remote locations year-round – often over featureless, flat terrain. Their inexperience in basic instrument flying can be expected to lead to a continuation of weather-related accidents in whiteout conditions.

The safety study suggests that more recently licensed helicopter pilots, who have acquired basic instrument flying experience to obtain their licence, will find that their instrument flying skills will deteriorate if not practised. Therefore, the benefit of one-time exposure to advanced flying skills acquired during licence training and necessary for a safe recovery from whiteout conditions, may be lost. There is no requirement to undergo refresher training in basic instrument flying as a condition of licence-revalidation, However, a commercially-employed pilot is required to submit to an annual Pilot Proficiency Check (PPC). An evaluation of a pilot's basic instrument flying skills during the PPC would ensure that commercially-employed helicopter pilots, regardless of when they had obtained their licence, would regularly demonstrate proficiency in skills necessary for coping with the major cause of VFR helicopter accidents in adverse weather. Therefore, the Board recommends that:

> The Department of Transport require verification of proficiency in basic instrument flying skills for commercially-employed helicopter pilots during annual pilot proficiency flight checks.
>
> TSB-A90-81

5.0 INDUSTRY PRACTICES

5.1 Risk Management – Commercial Operations

Approximately 35% of the accidents occurred to aircraft engaged in commercial operations. This proportion was considerably larger than that of commercial operators involved in American adverse-weather-related accidents (23%), even after the commercial flying hours of each country had been considered. This suggested that specific influences in the Canadian operating environment might have played an important role. When the Canadian accident data were examined on their own, it was found that the involvement of commercial operators in VFR-into-IMC accidents was disproportionately high when compared to all Canadian accidents, when compared to other categories of Canadian commercial accidents, and when compared to all adverse weather-related accidents.

Detailed analysis of these accidents found that the accident pilots were generally experienced in aircraft handling, even in adverse weather conditions. Consequently, the analysis focused on the circumstances which led to the flights being initiated or conducted in conditions which jeopardized the safety of the flight.

Many remote commercial operations are conducted in an environment of high physical and economic risk by aviation safety standards. Northern transportation is seasonal, and intensely active during the long summer hours of daylight. There are many pressures on the company, the client, and the pilot to get the job done, and failure to complete assignments can be measured in harsh economic terms. This industry is conducted in a most unforgiving physical environment, which often is intolerant of such short-term operating expedients as continuing flight into adverse weather. The annual record of commercial accidents occurring in adverse weather is testimony of an industry's inability to manage the risk of providing a safe air transportation service to the remotely-located communities and resource camps in Canada's hinterland.

Furthermore, the constituent parts of the industry's environment which affect the national safety record are not likely to change of their own accord in the future: commercial pilots are generally experienced and skilled; extremes of climate and geographic conditions will always prevail; even the economic determinants of low-capital investment and high economic risk will likely continue to exist.

The provision of air transportation services in this environment leads to pressures from management, the client, and the pilots themselves. To control or minimize the influences of these pressures requires excellent risk management practices. Indeed, a number of U.S. studies which examined the air charter industry in Alaska in the early eighties verified that sound operating practices and effective management of risk led to an improved company safety record. Transport Canada has undertaken a number of initiatives in the last decade to improve risk management procedures in the aviation sector. Some programs have aimed at influencing pilot decision-making before and during the flight, while other safety management programs, such as the Company Safety Officer Program and the Executive Safety Seminar aim at instilling the tenets of effective risk management amongst those responsible for the operation of a safe air transportation industry. Regrettably, many commercial weather-related accidents continue to be characterized by inappropriate operational decisions.

As a result of individual accident investigations, the CASB issued a number of Recommendations which sought change in particular aspects of the industry operations, changes which were intended to alter the management of risk industry-wide. Although most of the recommendations were accepted by TC, the findings of this study suggest that they have not had the cumulative effect of altering industry practices. Until there is a major evaluation of the conduct of high risk operations in a demanding and unforgiving physical environment – an evaluation involving such principal participants as government departments (in their roles as clients and as regulatory agents), the insurance industry, financial institutions, commercial operators and their employees – the Board believes that the factors which affect impaired decision-making will remain unattended and that the management of risk in this demanding environment will be less than optimal. Without a reassessment of the methods by which many small, commercial operations are conducted, the Board fears the continuation of a high fatality rate associated with VFR-into-IMC commercial accidents.

Rather than issue recommendations at this time to address this concern, the TSB will continue to monitor the safety of remote commercial operations.

5.2 Regulatory Standards for Commercial Operations

The air regulations are designed to ensure that the safety of the air transportation system does not fall below a minimum level. The regulatory standard for commercial operations is generally more stringent than those governing the private operation of aircraft, and is intended to provide a high standard of safety for the fare-paying passenger. Moreover, Canadian international air carriers and the larger domestic air carriers have traditionally adopted practices and procedures which further reduce the probability of an aviation occurrence. This 'margin of safety' which characterizes many of the larger commercial operations is not usually found in many of the smaller commercial operations, a segment of the industry which made up a large proportion of the VFR-into-IMC accidents.

This report has already commented on measures which would enhance the safety of many remotely-located commercial operations. The employment of instrument-qualified pilots; the operation of aircraft with enhanced communication equipment, certified for instrument flight rules; effective company safety programs; improved facilities and procedures for flight planning; and better use of pre-flight weather information are a few measures which the Board believes could reduce the incidence of VFR-into-IMC accidents involving commercial operations.

However, the Board believes that in light of the accident record of small commercial operations, and considering that there is, in general, a lower voluntary 'margin of safety' built into these operations, the regulations may require revision to safeguard the interests of the fare-paying public. The Board's concern is heightened in view of recent studies which have concluded that the accident rate for small companies operating fixed-wing aircraft in Canada has increased significantly in the past five years*.

* See for instance: "Evaluation of the Contribution of Aviation Safety Regulation and Aviation Safety Programs to Aviation Safety in Canada". Prepared by Sypher: Mueller International, 1990. page 3-19.

While examining commercial VFR-into-IMC accidents, it became clear that a number of major users of Canadian aviation charter services stipulate additional safety criteria when they contract air charter services. Major clients of Canadian charter services are demanding a higher standard of safety than the existing regulations and industry practices can provide. Oil companies, many air ambulance services, and a number of agencies and departments from various levels of government have adopted such practices.

The following are several examples of the higher standards demanded:

— Mandatory passenger briefings are recorded and signed by a designated passenger;

— extra survival equipment or overwater life-support equipment is often carried;

— many aircraft are equipped with additional navigation and radio communications equipment, with the stipulation that unserviceabilities in this equipment render the aircraft unserviceable;

— additional aircraft maintenance facilities are sometimes stipulated;

— the experience and training levels required for pilots under contract far exceed the legal minima;

— pilots are independently tested for pilot proficiency; and

— company facilities are audited by agents of the client.

The many examples of higher safety standards found in the course of the study suggest that TC's standards and audit procedures no longer meet the expectations of major clients of charter services. In light of the accident data, the Board believes that serious consideration must be given to instituting additional safety criteria into the regulatory standard, thereby ensuring that a high standard of safety is provided for all passengers who use the air transportation system. TC officials may wish to evaluate the existing practices of major clients of air charter systems to ascertain the most effective means by which the incidence and seriousness of VFR-into-IMC accidents could be reduced. Accordingly, the Board recommends that:

> The Department of Transport revise the safety standards for commercial operations to include requirements designed to reduce the probability and seriousness of VFR-into-IMC accidents.
>
> TSB-A90-82

6.0 AIRCRAFT EQUIPMENT

6.1 Radar Altimeters

Analysis of the accidents revealed few equipment deficiencies for either fixed-wing aircraft or helicopters. However as noted earlier, 27 of the 33 helicopter accidents occurred in whiteout conditions, and many of these occurred while in controlled flight. Many VFR-into-IMC helicopter accidents occurred as a result of inadvertent descent while flying over featureless terrain in conditions that often made it impossible for the pilot to accurately determine the altitude of the aircraft above the ground. Such descents could have been detected by the pilot if the aircraft had been equipped with an automated warning device, such as a radar altimeter, to signal the pilot of the ground's proximity. Only two accident helicopters were equipped with radar altimeters. In light of the conditions encountered in many of the helicopter accidents, where inadvertent descents were undetected by the pilot, the Board recommends that:

> The Department of Transport require all helicopters engaged in commercial passenger-carrying operations be equipped with radar altimeters.
>
> TSB-A90-83

6.2 Helicopter Instrumentation

The frequency with which helicopters crashed in whiteout conditions led the Board to recommend that commercial helicopter pilots regularly demonstrate sufficient proficiency in basic instrument flying skills (see section 4.5). However, it is well known that many commercial helicopters are not equipped with an artificial horizon, an important instrument for aircraft control when flying by sole reference to instruments. To ensure that commercial helicopter pilots operate aircraft adequately instrumented to escape from whiteout conditions, the Board recommends that:

> The Department of Transport require all commercially-operated helicopters to be equipped with appropriate instrumentation for the conduct of basic instrument flying.
>
> TSB-A90-84

7.0 OTHER TC SAFETY MEASURES

7.1 Safety Promotion

A large proportion of VFR-into-IMC accidents were attributable to inappropriate or faulty decision-making by pilots. TC safety promotional programs endeavour to illustrate that sound decision-making requires analysis of relevant information in the context of appropriate knowledge and consideration of the consequences of risk-taking. Through the production and distribution of newsletters, flyers, posters and audio-visual presentations, and by the development of safety programs aimed at influencing the safety of commercial operations, TC officials "market" the safety message.

In each TC region, a Regional Aviation Safety Officer (RASO) with a small staff supervises the company safety programs in the region, conducts confidential aviation safety surveys when requested by commercial operators, and liaises directly with the aviation public. The Headquarters staff in Ottawa produce the highly acclaimed safety newsletters and the instructional material for the various safety programs and the national safety campaigns. Approximately 28 full-time persons in the TC regions and Headquarters are dedicated to these responsibilities.

In light of the preference of the aviation industry to be informed rather than regulated, it is likely that additional resources expended on safety programs would positively influence industry practices and enhance aviation safety. Such an enhancement of decision-making skills by improved safety promotion would address the root cause of many accidents in Canada, not just VFR-in-IMC accidents.

This study did not attempt to evaluate TC's allocation of resources or the efficiency of its safety promotion activities; consequently, the Board will not make Recommendations regarding the allocation of resources to safety promotional programs in TC at this time. It does, however, heartily endorse the programs in-place, and encourages officials to continue to influence aviation safety through the development in the aviation industry of sound decision-making skills.

The study identified 44 private-business category accidents, which accounted for 55 fatalities in 29 fatal accidents. The pilots were generally experienced and Private-licensed, and were often operating in sparsely-settled areas. Circumstances of the flight often suggested the presence of personal or economic pressures to initiate or complete the flight. Commercial operations characterized by similar pressures are targeted by TC officials for regular auditing, and for specially-designed safety programs; however, no such measures specifically address private-business category operations. The Board, while respecting the limited resources presently allocated for safety promotional activities, believes that valuable safety dividends could be achieved by targeting private-business pilots with safety material relevant to their particular operating circumstances. To reduce the high number of fatalities in this category of accident, the Board recommends that:

> The Department of Transport develop and implement specially-designed safety promotional programs to reduce the incidence of private-business category VFR-into-IMC accidents.
>
> TSB-A90-85

7.2 TC Regulatory Audit and Certification

At least one-third of the studied accidents involved operations which were subject to TC audits. These audits seek to ensure that companies and pilots are adhering to minimum safety standards. Section Five of this report dealt with the Board's concerns about industry practices, many of which are not influenced by regulatory criteria; this section addresses the effectiveness of regulatory procedures to evaluate an important aspect of a company's safety, the pilot's inflight skills. At present, the skill of commercially-employed pilots operating small, multi-engined fixed-wing aircraft in VFR operations is evaluated by an annual PPC. The PPC focuses on aircraft handling skills and essential technical knowledge required for the safe operation of the aircraft.

Technical piloting skills were seldom found wanting in the accidents examined in this study, suggesting that the present method of evaluating pilots' skills do not address the root causes of most commercial VFR-into-IMC accidents. The study indicates that without some means of evaluating pilots' decision-making skills, professional inadequacies will go undetected until after an accident has occurred. This principle has led to a number of recent initiatives in the aviation industry. Line Oriented Flight Training (LOFT) and Cockpit Resource Management (CRM) have improved pilot decision-making skills throughout the world in larger commercial operations. TC is presently undertaking measures to incorporate an evaluation of Pilot decision-making skills into the Private Pilot Licence flight test. The Board supports this, and it believes that similar initiatives to train and evaluate pilots employed in smaller commercial operations in decision-making skills would reduce the incidence of VFR-into-IMC accidents. Accordingly, the Board recommends that:

> The Department of Transport devise and implement a means of regularly evaluating the practical decision-making skills of commercially-employed pilots engaged in small air carrier operations.
>
> TSB-A90-86

7.3 Weather Recording and Briefing Facilities

The adequacy of weather recording, forecasting and briefing as it pertained to VFR-into-IMC accidents was examined. Limitations in the accident data sometimes hampered the analysis of this issue; however, weather forecasting was found to be generally accurate, and inaccuracies seldom played a significant role in the occurrences.

Weather observation sites logically tend to be located at or near airports, where the regular measurement of weather phenomena is required for aircraft movements. Conversely, few observation sites are located in sparsely inhabited areas. In mountainous terrain, local conditions may vary widely from valley to valley, and differ significantly from the general area forecast. Such variations, particularly if they occur enroute, are apt to go undetected.

Advances in technology are leading towards automated measurement of weather phenomena. Transport Canada plans to have an Automated Weather Observation System (AWOS) partially in place by 1993. However, it will be well into the new century before fully functioning AWOS are installed at the locations initially designated for AWOS across Canada. TC will initially locate AWOS only in support of IFR operations; once these IFR sites are in-place, a limited number of observation sites may be positioned in locations such

as selected mountain passes to support VFR operations. The Board is concerned that TC's introduction of AWOS to support IFR operations only may not take adequate account of the Canadian accident experience, and may not be the most effective utilization of this technology. In light of the frequency of fatal VFR-into-IMC accidents involving aircraft operating enroute through mountains and sparsely-inhabited regions, where deteriorating local weather conditions go unobserved with often fatal consequences, the Board believes that enroute VFR flights warrant a higher priority in being served by AWOS. Accordingly, the Board recommends that:

> The Department of Transport locate automated weather measuring devices in support of VFR operations in the areas of highest risk in mountainous terrain.
>
> TSB-A90-87

The Board recognizes that AWOS sites will not be in-place for many years. Presently, TC maintains a limited number of contract weather observation sites, particularly in British Columbia. Local inhabitants under contract are trained to operate basic weather observation equipment. Thus, at relatively little expense, TC disseminates information about adverse weather conditions at remote, enroute locations which otherwise would go unreported.

The Board believes that while AWOS is being introduced in the next decade, additional manned observation sites would be an inexpensive means of enhancing the reporting of adverse enroute weather in the sparsely-settled regions, particularly in mountainous terrain. Accordingly, the Board recommends that:

> The Department of Transport examine the policy for the contracting of manned weather observation services with a view to expanding the service in remote locations of highest risk.
>
> TSB-A90-88

Weather briefing facilities were not available to pilots in over one-third of the accidents occurring in the sparsely-settled area. Fifty percent and 33% of the pilots in the helicopter and mountain-commercial accident groups, respectively, had no access to weather briefings prior to the accident flight. The Board is concerned that this situation persists; facilities exist which can provide remotely-located pilots with timely weather information. High Frequency (HF) communications equipment permits long-distance communications between an aircraft and a ground-based weather briefer, even when the aircraft is on the ground, several hundred miles distance from the briefer. Furthermore, technological advances, including satellite relays, are effectively reducing the remoteness of many locations in Canada. In light of the large proportion of pilots engaged in remote commercial operations who did not have ready access to weather briefing facilities prior to the accident, the Board recommends that:

> The Department of Transport promote the upgrading of weather briefing facilities where required, for remotely-located commercial operations, and encourage commercial operators to provide crews with the means of obtaining a weather briefing for all flights.
>
> TSB-A90-89

Transport Canada has recently introduced a transcribed weather service aimed at improving the provision of weather information to pilots. With prior coordination, taped weather

information can be transmitted at a predetermined time on an Non-Direction Beacon (NDB) frequency. In this manner, commercial operators or private recreational pilots can obtain weather information prior to or just after departure from remote sites at which no briefing facilities exist. Regrettably, TC officials report that this service is seldom requested. Earlier sections of this report have emphasized the need for pilots to have timely and accurate weather information for sound decision-making. In light of the large number of VFR-into-IMC accidents which occurred in remote locations where no weather briefing could be obtained through traditional methods, the Board recommends that:

> The Department of Transport publicize the availability of Transcribed Weather Services at remote locations.
>
> TSB-A90-90

8.0 CONCLUSION

Accidents involving continued VFR-into-IMC account for a disproportionate number of fatalities each year. The causes and contributing factors to these accidents have recurring themes. These include inappropriate pilot qualifications or proficiency for the conditions encountered, and serious shortcomings in the permissable weather minima for VFR flight, in pilot training, and in pilot licence privileges. In some cases, current industry practices and limitations in aircraft equipment and weather briefing facilities exacerbated the circumstances leading up to the accidents. Since the phenomenon is not limited to any particular sector of the aviation community, diverse action is required. The Board believes that full implementation of the recommendations made in the report will go a long way towards redressing the pervasive conditions leading to this type of accident which annually claims so many fatalities.

ANNEX A

SELECTED DEFINITIONS

Ceiling: The lowest height at which a broken or overcast condition exists, or the vertical visibility when an obscured condition such as snow, smoke or fog exists, whichever is the lower.

Commercial Aircraft: An aircraft operated or available for operation for hire or reward.

Commercial Air Service: Any use of aircraft for hire or reward.

Controlled Airspace: An airspace of defined dimensions within which air traffic control service is provided.

Daylight: In respect of any place in Canada, the period of time in any day when the centre of the sun's disc is less than 6" below the horizon, and in any place where the sun rises and sets daily, may be considered to be the period of time commencing 1/2 hour before sunrise and ending 1/2 hour after sunset.

Day VFR: In respect of the flight of any aircraft in Canada, a flight conducted in accordance with VFR during the hours of daylight.

Flight Visibility: The average range of visibility at any given time forward from the cockpit of any aircraft in flight.

Instrument Flight Rules: The rules set forth in the Air Regulations and in the orders and directions made by the Minister thereunder.

IFR: The instrument flight rules.

IFR Aircraft: An aircraft in IFR flight.

IFR Flight: A flight conducted in accordance with the instrument flight rules.

IFR Weather Conditions: Weather conditions below the minima prescribed for VFR flight.

Night: In respect of any place in Canada, the period of time when the centre of the sun's disc is more than 6" below the horizon and, in any place where the sun rises and sets daily, may be considered to be the period of time commencing 1/2 hour after sunset and ending 1/2 hour before sunrise.

Night VFR: In respect of a flight of any aircraft in Canada, a flight conducted in accordance with VFR during the hours of night.

Serviceable: In respect of an aircraft or aircraft part, in a fit and safe state for flight.

Special VFR Flight:	A visual flight authorized by an air traffic control unit to operate within a control zone under meteorological conditions that are below VFR weather conditions.
VFR:	The visual flight rules.
VFR Flight:	A flight conducted in accordance with the visual flight rules.
VFR Weather Conditions:	Weather conditions equal to or above the minima prescribed pursuant to section 543 of the Air Regulations.
Visibility:	The distance at which prominent unlighted objects may be identified by day and prominent lighted objects may be identified at night.
Visual Flight Rules:	Means the rule set forth in Division III of Part V of the Air Regulations and in the orders and directions made by the Minister thereunder.

ANNEX B

CROSS-REFERENCE OF SAFETY RECOMMENDATIONS

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ANNEX C

GLOSSARY

ADF	automatic direction finder
agl	above ground level
asl	above sea level
ATC Unit	Air Traffic Control Unit
ATS	Air Traffic Services
AWOS	Automated Weather Observation System
CASB	Canadian Aviation Safety Board
CRM	Cockpit Resource Management
DOT	Department of Transport
FAA	Federal Aviation Administration
HF	high frequency
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
LOFT	Line Oriented Flight Training
NDB	non-directional beacon
NTSB	National Transportation Safety Board
PPC	Pilot Proficiency Check
RASO	Regional Aviation Safety Officer
SVFR	Special Visual Flight Rules
TC	Transport Canada
TSB	Transportation Safety Board of Canada
VFR	Visual Flight Rules
VMC	Visual Meterological Conditions